

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

What is claimed is:

1. (Currently amended) A method of treating a subterranean formation comprising:
providing a treatment fluid that comprises a surfactant-free emulsion, the surfactant-free emulsion comprising an oleaginous fluid, a fluid that is at least partially immiscible with the oleaginous fluid, and non-surfactant ethylacrylate/methylacrylic acid polymeric emulsifier having hydrophilic moieties and hydrophobic moieties; and treating the subterranean formation; wherein the polymeric emulsifier has a molecular weight ~~between about 2000 and~~ of about 100,000, is substantially absorbed at the oil water interface of the emulsion, and has an internal phase fraction of about 0.1% to about 96%.
2. (Original) The method of claim 1 wherein the non-surfactant polymeric emulsifier interacts with the oleaginous fluid and the fluid that is at least partially immiscible with the oleaginous fluid to at least partially stabilize the surfactant-free emulsion.
3. (Original) The method of claim 1 wherein the method of treating the subterranean formation comprises a stimulation operation.
4. (Original) The method of claim 3 wherein the stimulation operation comprises a fracturing operation.
5. (Original) The method of claim 3 wherein the stimulation operation comprises an acid stimulation treatment.
6. (Original) The method of claim 5 wherein the acid stimulation treatment comprises a matrix acidizing process or a fracture acidizing process.

7. (Original) The method of claim 1 wherein the method of treating a subterranean formation comprises completing a well.
8. (Original) The method of claim 1 wherein the method of treating a subterranean formation comprises drilling a well bore.
9. (Original) The method of claim 1 further comprising flowing back a portion of the treatment fluid from the subterranean formation.
10. (Original) The method of claim 9 wherein the treatment fluid further comprises a breaker.
11. (Original) The method of claim 1 wherein the surfactant-free emulsion comprises a continuous phase and a discontinuous phase.
12. (Original) The method of claim 11 wherein the continuous phase comprises the oleaginous fluid.
13. (Original) The method of claim 11 wherein the continuous phase comprises the fluid that is at least partially immiscible with the oleaginous fluid.
14. (Original) The method of claim 1 wherein the hydrophilic and hydrophobic moieties of the non-surfactant polymeric emulsifier are balanced so as to promote and stabilize emulsification of the treatment fluid.
15. (Canceled)
16. (Original) The method of claim 1 wherein said emulsion has a high internal phase fraction.
17. (Currently amended) The method of claim 1 wherein said emulsion has an internal phase fraction ~~in the range~~ of at least about 96%.

18. (Original) The method of claim 1 wherein the non-surfactant polymeric emulsifier comprises a non-surfactant polymer or combination of non-surfactant polymers.
19. (Original) The method of claim 18 wherein said polymers are amphoteric.
20. (Original) The method of claim 1 wherein the oleaginous fluid comprises diesel oil, crude oil, paraffin oil, olefin, ester, amide, amine, synthetic oil, ether, acetal, dialkyl carbonate, other hydrocarbons not a surfactant, or combinations thereof.
21. (Original) The method of claim 1 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises fresh water, sea water, salt water, or brine.
22. (Original) The method of claim 21 wherein the brine comprises a H₂O soluble salt.
23. (Original) The method of claim 1 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises a heavy brine.
24. (Original) The method of claim 1 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises glycerin, polyglycol amine, glycol, polyol, a derivative thereof, or a combination thereof.
25. (Original) The method of claim 1 wherein the treatment fluid further comprises one or more non-surfactant additives comprising proppant particulates, gravel particulates, viscosifier, thinner, lubricant, anti-oxidant, weighting agent, H₂O soluble salt, wetting agent, fluid loss agent, corrosion inhibitor, or scale inhibitor.
26. (Currently amended) A method comprising:
 - drilling a well bore in a subterranean formation using a surfactant-free emulsion drilling fluid that comprises:
 - an oleaginous fluid;
 - a fluid that is at least partially immiscible with the oleaginous fluid; and

non-surfactant ethylacrylate/methacrylic acid polymeric emulsifier having a molecular weight of about 100,000 and hydrophilic and hydrophobic moieties such that the emulsifier is substantially absorbed at the emulsion interface between the oleaginous fluid and the at least partially immiscible fluid.

27. (Original) The method of claim 26 wherein the non-surfactant polymeric emulsifier is amphoteric.
28. (Canceled)
29. (Original) The method of claim 26 wherein said emulsion has a high internal phase fraction.
30. (Original) The method of claim 26 wherein said emulsion has an internal phase fraction in the range of about 0.1% to about 96%.
31. (Original) The method of claim 26 wherein the non-surfactant polymeric emulsifier comprises a polymer or combination of polymers.
32. (Original) The method of claim 26 wherein the oleaginous fluid comprises diesel oil, crude oil, paraffin oil, olefin, ester, amide, amine, synthetic oil, ether, acetal, dialkyl carbonate, other hydrocarbons not a surfactant, or combinations thereof.
33. (Original) The method of claim 26 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises fresh water, sea water, salt water, or brine.
34. (Original) The method of claim 33 wherein the brine comprises a H₂O soluble salt.
35. (Original) The method of claim 26 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises a heavy brine.

36. (Previously presented) The method of claim 26 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises glycerin, polyglycol amine, polyol, a derivative thereof, or a combination thereof.

37. (Original) The method of claim 26 wherein the treatment fluid further comprises one or more non-surfactant additives comprising a viscosifier, a thinner, a lubricant, an anti-oxidant, a weighting agent, an H₂O soluble salt, a wetting agent, a fluid loss agent, a corrosion inhibitor, or a scale inhibitor.

38. (Withdrawn) A method of emulsifying crude oil comprising:

providing crude oil, fluid that is at least partially immiscible with the crude oil, and non-surfactant polymeric emulsifier having both hydrophilic and hydrophobic groups; and

mixing the crude oil, the fluid that is at least partially immiscible with the crude oil, and the non-surfactant polymeric emulsifier so as to form a surfactant-free crude oil emulsion.

39. (Withdrawn) The method of claim 38 wherein the fluid that is at least partially immiscible with the crude oil comprises fresh water, sea water, salt water, brine glycerin, polyglycol amines, glycols, polyols, derivatives thereof, or combinations thereof.

40. (Withdrawn) The method of claim 39 wherein the brine comprises a H₂O soluble salt.

41. (Withdrawn) The method of claim 38 wherein the non-surfactant polymeric emulsifier has a molecular weight in the range of about 2000 to about 100,000.

42. (Withdrawn) The method of claim 41 wherein the surfactant-free crude oil emulsion further comprises a weighting agent, H₂O soluble salt, a wetting agent, a fluid loss agent, a corrosion inhibitor, or a scale inhibitor.

43. (Withdrawn) A surfactant-free crude oil emulsion produced according to the method of claim 38.

44. (Withdrawn) A method of making a drilling fluid that comprises a surfactant-free emulsion comprising: mixing oleaginous fluid, fluid that is at least partially immiscible with the oleaginous fluid, and non-surfactant polymeric emulsifier having both hydrophilic and hydrophobic moieties so as to form a surfactant-free emulsion.
45. (Withdrawn) The method of claim 44 wherein the non-surfactant polymeric emulsifier is amphoteric .
46. (Withdrawn) The method of claim 44 wherein the non-surfactant polymeric emulsifier has a molecular weight between about 2000 and about 100,000.
47. (Withdrawn) The method of claim 44 wherein said emulsion has a high internal phase fraction.
48. (Withdrawn) The method of claim 44 wherein the non-surfactant polymeric emulsifier comprises a polymer or combination of polymers.
49. (Withdrawn) The method of claim 44 wherein the oleaginous fluid comprises diesel oil, crude oil, paraffin oil, olefin, ester, amide, amine, synthetic oil, ether, acetal, dialkyl carbonate, other non-surfactant hydrocarbons, or combinations thereof.
50. (Withdrawn) The method of claim 44 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises fresh water, sea water, salt water, or brine.
51. (Withdrawn) The method of claim 50 wherein the brine comprises a H₂O soluble salt.
52. (Withdrawn) The method of claim 44 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises a heavy brine.
53. (Withdrawn) The method of claim 44 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises glycerin, polyglycol amine, glycol, polyol, a derivative thereof, or a combination thereof.

54. (Withdrawn) A method of claim 44 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises fresh water, sea water, salt water, brine, glycerin, polyglycol amines, glycols, polyols, derivatives thereof, or combinations thereof.
55. (Withdrawn) The method of claim 44 further comprising adding one or more non-surfactant additives comprising a viscosifier, a thinner, a lubricant, an anti-oxidant, a weighting agent, an H₂O soluble salt, a wetting agent, a fluid loss agent, a corrosion inhibitor, or a scale inhibitor to the emulsion.
56. (Withdrawn) A drilling fluid produced according to the method of claim 44.
57. (Currently amended) A method of fracturing a subterranean formation comprising:
providing a surfactant-free emulsion composition comprising an oleaginous fluid, a fluid that is at least partially immiscible with the oleaginous fluid, a non-surfactant ethylacrylate/methacrylic acid polymeric emulsifier having a molecular weight of about 100,000 and hydrophilic and hydrophobic moieties such that the polymeric emulsifier is substantially absorbed at the oil water emulsion interface, and proppant particulates; and
placing the surfactant-free emulsion composition into the subterranean formation at a pressure sufficient to create or enhance at least one fracture therein.
58. (Original) The method of claim 57 wherein the surfactant-free emulsion composition further comprises a breaker.
59. (Original) The method of claim 57 further comprising removing the surfactant-free emulsion composition from the subterranean formation while leaving at least a portion of the proppant particulates in the fracture.
60. (Original) The method of claim 59 wherein said removal of the emulsion is effected with a breaker that breaks down the polymeric emulsifier.

61. (Currently amended) A method of installing a gravel pack comprising:
- providing a gravel pack surfactant-free emulsion composition comprising an oleaginous fluid, a fluid that is at least partially immiscible with the oleaginous fluid, a non-surfactant ethylacrylate/methacrylic acid polymeric emulsifier having a molecular weight of about 100,000 and hydrophilic and hydrophobic moieties, and gravel particulates; and
- introducing the composition to a well bore penetrating a subterranean formation so that the gravel particulates form a gravel pack substantially adjacent to a desired location in the well bore.
62. (Withdrawn) A drilling fluid composition that comprises a surfactant-free emulsion comprising:
- an oleaginous fluid;
- a fluid that is at least partially immiscible with the oleaginous fluid; and
- a non-surfactant polymeric emulsifier having both hydrophilic groups and hydrophobic groups.
63. (Withdrawn) The composition of claim 62 wherein the surfactant-free emulsion comprises a continuous phase and a discontinuous phase.
64. (Withdrawn) The composition of claim 62 wherein the continuous phase comprises the oleaginous fluid.
65. (Withdrawn) The composition of claim 62 wherein the continuous phase comprises the fluid that is at least partially immiscible with the oleaginous fluid.
66. (Withdrawn) The composition of claim 62 wherein the non-surfactant polymeric emulsifier is amphoteric.
67. (Withdrawn) The composition of claim 62 wherein the non-surfactant polymeric emulsifier has a molecular weight between about 2000 and about 100,000.

68. (Withdrawn) The composition of claim 62 wherein said emulsion has a high internal phase fraction.
69. (Withdrawn) The composition of claim 62 wherein the non-surfactant polymeric emulsifier comprises a polymer or combination of polymers.
70. (Withdrawn) The composition of claim 62 wherein the oleaginous fluid comprises diesel oil, crude oil, paraffin oil, olefin, ester, amide, amine, synthetic oil, ether, acetal, dialkyl carbonate, other non-surfactant hydrocarbons, or combinations thereof.
71. (Withdrawn) The composition of claim 64 wherein the fluid that is at least partially immiscible with the oleaginous fluid comprises fresh water, sea water, salt water, brine, glycerin, polyglycol amines, glycols, polyols, derivatives thereof, or combinations thereof.
72. (Withdrawn) The composition of claim 71 wherein the brine comprises a H₂O soluble salt.
73. (Withdrawn) The composition of claim 72 wherein the H₂O soluble salt comprises zinc bromide, calcium bromide, calcium chloride, sodium chloride, sodium bromide, sodium formate, potassium formate, sodium acetate, potassium acetate, calcium acetate, ammonium acetate, ammonium chloride, ammonium bromide, sodium nitrate, potassium nitrate, ammonium nitrate, calcium nitrate, sodium carbonate, potassium carbonate, or combinations thereof.
74. (Withdrawn) The composition of claim 62 further comprising one or more additives comprising a viscosifier, a thinner, a lubricant, an anti-oxidant, a weighting agent, an H₂O soluble salt, a wetting agent, a fluid loss agent, a corrosion inhibitor, a surfactant, or a scale inhibitor.
75. (Withdrawn) The composition of claim 72 wherein the H₂O soluble salt comprises any salt which reduces the water phase activity of the surfactant-free emulsion.

76. (Withdrawn) A well treatment fluid comprising a surfactant-free emulsion, wherein the surfactant-free emulsion comprises:

an oleaginous fluid;

a fluid that is at least partially immiscible with the oleaginous fluid; and

a non-surfactant polymeric emulsifier having both hydrophilic groups and hydrophobic groups.

77. (Withdrawn) The treatment fluid of claim 76 wherein the surfactant-free emulsion is electrically stable from a range of about 20 volts to about 2000 volts.

78. (Withdrawn) The treatment fluid of claim 76 further comprising one or more additives comprising a viscosifier, breaker, weighting agent, H₂O soluble salt, or wetting agent.

79. (Withdrawn) The treatment fluid of claim 76 wherein the treatment fluid is used as a fracturing fluid or a gravel packing transport fluid.